

## Notes on Olpiidae (Arachnida: Pseudoscorpiones) from Iran: description of *Cardiolum bisetosum* sp. nov. and redescription of *Olpium omanense*

Mahrad Nassirkhani

doi: 10.5431/aramit5001

**Abstract.** Recent collections of pseudoscorpions resulted in a first record and a new species from Iran. *Olpium omanense* Mahnert, 1991 originally described from Oman is recorded for the first time from Iran. Three congeneric species with similar morphometric characters and trichobothrial patterns, *Olpium intermedium* Beier, 1959, *O. lindbergi*, Beier, 1959 and *O. omanense* can be separated by the setal numbers on the posterior margin of the carapace and tergite I. Also, specimens reported as *Olpium lindbergi* Beier, 1951 from Pakistan were probably misidentified and belong to *O. omanense*. The new species *Cardiolum bisetosum* sp. nov. is described based on males from Markazi province, western Iran. Morphometric data is given in comparison to related species.

**Keywords:** distribution, intraspecific variation, Middle East, morphometry, pseudoscorpions, taxonomy.

**Zusammenfassung.** Olpiidae (Arachnida: Pseudoscorpiones) aus dem Iran: Beschreibung von *Cardiolum bisetosum* sp. nov. und *Olpium omanense*. Bei Pseudoskorpion-Erfassungen im Iran wurden ein Erstnachweis und eine neue Art gefunden. *Olpium omanense* Mahnert, 1991 wurde ursprünglich aus dem Oman beschrieben und kann nun zum ersten Mal im Iran nachgewiesen werden. Drei eng verwandte Arten mit ähnlichen morphometrischen Eigenschaften und Trichobothrien-Mustern, *Olpium intermedium* Beier, 1959, *O. lindbergi*, Beier, 1959 und *O. omanense* können anhand der Anzahl der Setae am posterioren Rand des Carapax und am Tergit I unterschieden werden. Bei den Nachweisen von *Olpium lindbergi* Beier, 1951 aus Pakistan handelt es sich wahrscheinlich um Fehlbestimmungen – alle Individuen gehören zu *O. omanense*. Eine neue Art *Cardiolum bisetosum* sp. nov. wird nach Männchen aus der Markazi-Provinz im Westen Irans beschrieben. Vergleichende morphometrische Daten zu verwandten Arten werden präsentiert.

Based on recent faunistic sampling in southern and western Iran, two species belonging to the family Olpiidae are reported here for the first time. The family currently contains 36 genera and 268 species from most terrestrial regions of the world (Harvey, 2013). They occur in many different ecosystems, but are more prevalent in dry habitats. Olpiids are found in most regions of the world, but are mostly found in xeric habitats. The pseudoscorpion family Olpiidae is currently represented by two genera and four species from Iran: *Minniza babylonica* Beier, 1931 from Kerman and Shiraz Provinces (Beier 1951, 1971), *M. persica* Beier, 1951 from Bandare-Abbass and Lahigan cities (Beier 1951, 1971, Nassirkhani & Vafai 2014), *Calocheiridius centralis* (Beier, 1952) from Shiraz and Khoozestan cities (Beier, 1971) and *C. iranicus* Nassirkhani 2014 from Markazi Province (Nassirkhani 2014). A further species, *Minniza syriaca* Beier, 1951, was reported from Arak, Isfahan and Shiraz cities (Beier 1951), but has

been synonymized with *M. babylonica* by Mahnert (1991). Recent collecting in Iran recovered specimens of *Olpium* L. Koch, 1873, which represent the first record of this genus from Iran, as well as two specimens of a new species of *Cardiolum* Mahnert, 1986.

### Material and methods

The specimens used in this study were collected from Kerman and Markazi Provinces. *Olpium omanense* Mahnert, 1991 was collected by sieving litter consisting of leaf and bark pieces, and *Cardiolum bisetosum* sp. nov. was extracted from soil and leaf litter with a Berlese funnel. All specimens were preserved in 70 % ethanol and prepared for study as follows: the pedipalps, chelicerae, first and fourth legs were dissected, cleared in 60 % lactic acid, and permanently mounted on dished glass microscope slides in Hoyer's medium (a mixture of distilled water, chloral hydrate, Arabic gum and glycerin). The specimens were examined and illustrated with an Olympus BH-2 compound microscope and a drawing tube attachment. The specimens are lodged in the Collection of the Acarology Laboratory, Islamic Azad University of Arak (IAUA), Iran.

Mahrad NASSIRKHANI, Entomology Department, Faculty of Agriculture and Natural Resources, Islamic Azad University, Arak branch, Arak, Iran; E-mail: greenartificialturfgrass@gmail.com

submitted 5.1.2015, accepted 10.4.2015, online 29.6.2015

Morphological terminology and mensuration follow Chamberlin (1931), Harvey (1992), Judson (2007) and Harvey et al. (2012). The following trichobothrial abbreviations were used: *eb* = external basal; *esb* = external sub-basal; *ib* = internal basal; *isb* = internal sub-basal; *ist* = internal sub-terminal; *est* = external sub-terminal; *it* = internal terminal; *et* = external terminal; *t* = terminal; *st* = sub-terminal; *b* = basal; *sb* = sub-basal. In addition, the following abbreviations are used: mm = millimeter; H = height; L = length; W = width and D = depth.

### Family Olpiidae Banks, 1895

### Subfamily Olpiinae Banks, 1895

### Genus *Olpium* L. Koch, 1873

**Type species.** *Obisium pallipes* Lucas, 1849, by subsequent designation of the International Commission of Zoological Nomenclature (1987: 53).

**Remarks.** *Olpium* can be separated from *Calocheiridius* by the position of trichobothrium *ib* which is located basally or sub-basally, and trichobothrium *it*, which is situated distal to *est* and the position of the nodus ramosus which is located proximal to *et* (Dashdamirov & Schawaller 1993). Also, the pedipalpal shape and male genital organs (see Fig. 15) are very different between the genera, e.g., the movable chelal finger of most *Calocheiridius* species are shorter than the hand (with pedicel) while the movable chelal finger of *Olpium* species are distinctly longer than the hand (with pedicel). Members of the genus *Minniza* Simon, 1881 can be distinguished from *Olpium* and *Calocheiridius* by the following combination of characters: the large body and long abdomen; the presence of two distinct transverse furrows on the carapace; the proportion of the carapace which is distinctly longer than wide; the presence of distinct short venom ducts in both fingers (except *M. barkhamae* Mahnert, 1991 with long venom ducts that reach to trichobothria *et* in the fixed and *t* in the movable chelal fingers (Mahnert 1991)) and the male genital organs (see Fig. 15).

### *Olpium omanense* Mahnert, 1991 (Figs 1-7, 15a)

**First description.** Mahnert (1991: 175-177, Figs 13-18).

**Material examined.** IRAN: Kerman Province: 10 ♂, 1 ♀, Khabr National Park, Baft, litter, [28°52'45"N, 56°23'56"E, 2050m H.], 18 July 2013, M. Nassirkhani (IAUA). 2 ♂, Rabor, Baft, litter, [29°29'47"N, 56°26'18"E, 2500 m H.], 20 July

2013, M. Nassirkhani (IAUA). Markazi Province: 1 ♀, Deh-e-No, Khorzan Village, soil and leaf litter, [33°38'14"N, 49°57'30"E, 2000 m H.], 8 June 2013, M. Nassirkhani (IAUA).

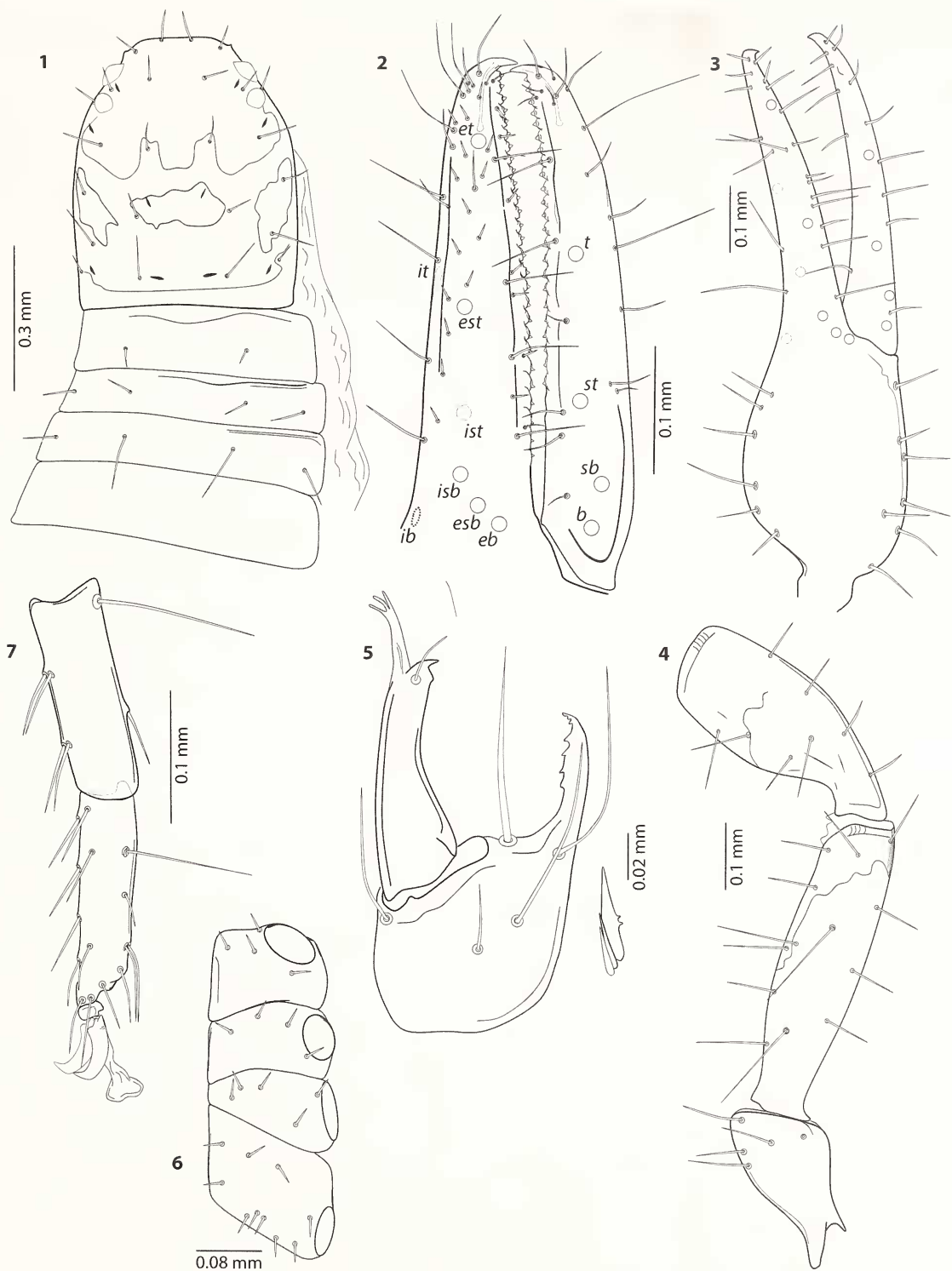
**Redescription.** *Carapace*: reddish-brown; entire-ly smooth; distinctly longer than wide; with 2 pairs of well-developed corneate eyes, anterior eyes larger and wider than posterior eyes, anterior eyes extending to lateral margin, posterior eyes slightly spaced from lateral margin (Fig. 1); with indistinct anterior transverse furrow (Fig. 1); posterior furrow present; setae simple, thin and acute; carapace with 28 (27) setae, mostly arranged: 4: 6: 4: 4: 2: 4 [four specimens with 3 setae on posterior margin]; with 10 lyrifissures, first lyrifissures located between anterior and posterior eyes, second lyrifissures situated slightly proximal to posterior eyes, third lyrifissures situated medially, closer to anterior furrow than posterior furrow and last lyrifissures situated on posterior margin.

*Tergites*: lightly sclerotized and not granulate; without median suture line; lighter in colour than carapace, light brown with pale margins, terminal tergites darker in colour than basal tergites; setae simple, narrow and acute; tergites X and XI with 2 long tactile setae situated latero-medially; tergites with setae arranged: 2[only in one specimen with 3]: 4: 4: 4: 4: 4: 4: 4: 6: 2.

*Sternites*: poorly sclerotized and smooth; without median suture line; sternite II with 10-15 simple setae in males and 6 in females and 8-10 large lyrifissures in males and 5 in females; males with lateral genital sacs with very long ducts, with 2 pairs of internal glandular setae (Fig. 15a); female with three cribriform plates, central plate larger than lateral plates; setae narrower and longer than tergal setae; sternite X with 2 long tactile setae and 2 slightly long setae; sternite XI with 4 long tactile setae; spiracles without setae, with normal enlarged tracheal trunks, posterior trachea thinner than anterior trachea; sternites with setae arranged: 10-15: (0)4-7(0): (0)5-6(0): 5-6: 4-6: 4: 4: 6: 6: 6: 2 for males and 6: (0)4(0): (0)4(0): 5: 4: 4: 6: 6: 6: 6: 2 for females.

*Pleural membrane*: longitudinally striate.

*Chelicera*: brown, lighter in colour than carapace and abdomen; galeal seta present and situated distally; galea with 3 terminal rami; hand with 5 setae (Fig. 5); rallum with 3 blades, distal blade longest and widest with short lateral denticulations (Fig. 5); serrula exterior with 14-17 blades; lamina exterior present on fixed finger; fixed finger with 6 teeth, distal



**Figs 1-7:** *Olpium omanense* Mahnert, 1991, male from Kerman Province, Iran: **1.** Carapace and tergite I, dorsal view; **2.** Chelal fingers, prolateral view (showing trichobothrial setae, nodus ramosus, venom ducts and chelal teeth); **3.** Right chela, retrolateral-dorsal view; **4.** Basal segments of pedipalp, dorsal view; **5.** Chelicera (serrula omitted), dorsal view and rallum; **6.** Left coxae, ventral view; **7.** Tarsus and metatarsus IV



**Tab. 1:** Dimensions (in mm) and ratios of morphological characters in *Olpium omanense* Mahnert, 1991

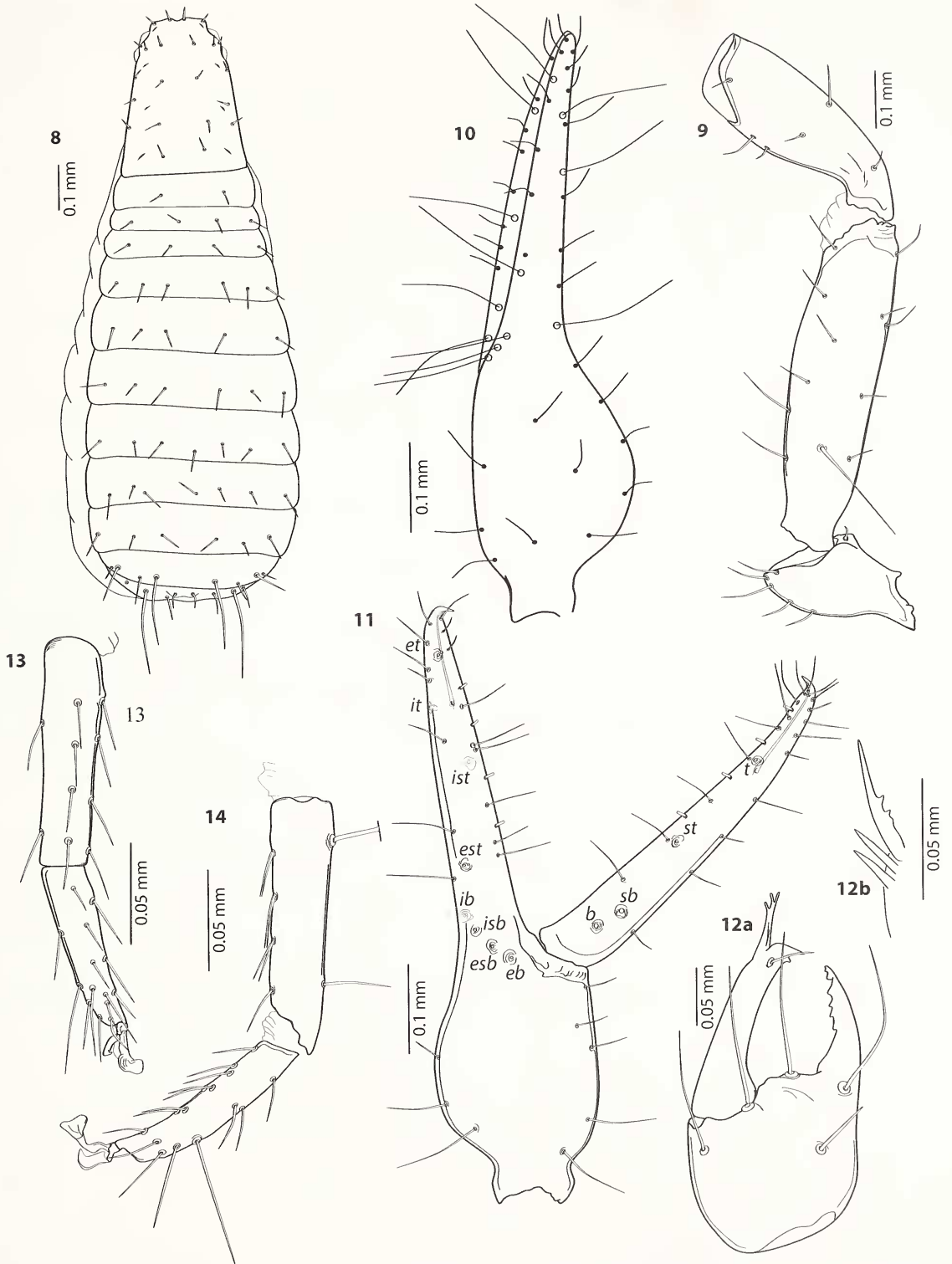
	Length	Width	Ratio
<i>Body</i>	1.90-2.10♂ 2.40-2.49♀	-	-
<i>Carapace</i>	0.53-0.59♂ 0.63♀	0.42-0.45♂ 0.46-0.47♀	1.26-1.35♂ 1.34-1.36♀
<i>Pedipalp</i>			
Trochanter	0.25-0.27♂ 0.29♀	0.13-0.15♂ 0.15♀	1.80-1.92♂ 1.93♀
Femur	0.44-0.48♂ 0.48♀	0.13-0.14♂ 0.14♀	3.21-3.61♂ 3.43♀
Patella	0.38-0.42♂ 0.43♀	0.15-0.16♂ 0.17♀	2.50-2.73♂ 2.52♀
Chela (with pedicel)	0.80-0.84♂ 0.89♀	0.23-0.25♂ 0.27♀	3.30-3.48♂ 3.29♀
Chela (without pedicel)	0.75-0.78♂ 0.83♀	-	3.08-3.26♂ 3.07♀
Hand (with pedicel)	0.35-0.40♂ 0.41♀	-	1.52- 1.60♂,♀
Movable finger	0.46-0.48♂ 0.50♀	-	-
<i>Legs</i>	Length	Depth	Ratio
<i>Leg I</i>			
Femur	0.19-0.21♂ 0.21♀	0.08♂ 0.085♀	2.22-2.62♂ 2.33♀
Patella	0.14-0.16♂ 0.16♀	0.08-0.09♂ 0.09♀	1.55-2.00♂ 1.70♀
Tibia	0.20-0.22♂ 0.22♀	0.05-0.06♂ 0.06♀	3.50-4.40♂ 3.66♀
Metatarsus	0.10-0.12♂ 0.11♀	0.04♂ 0.04♀	2.50-3.00♂ 2.75♀
Tarsus	0.11-0.12♂ 0.12♀	0.03♂ 0.03♀	3.66-4.00♂ 4.00♀
<i>Leg IV</i>			
Femur	0.12-0.14♂ 0.14♀	0.09-0.11♂ 0.11♀	1.09-1.55♂ 1.27♀
Patella	0.35-0.40♂ 0.40♀	0.18-0.19♂ 0.18♀	1.94-2.22♂ 2.22♀
Femur + patella	0.42-0.48♂ 0.47♀	0.18-0.19♂ 0.18♀	2.38-2.66♂ 2.61♀
Tibia	0.30-0.34♂ 0.34♀	0.09♂ 0.09♀	3.33-3.77♂ 3.77♀
Metatarsus	0.14-0.15♂ 0.15♀	0.05♂ 0.05♀	2.80-3.00♂ 3.00♀
Tarsus	0.15-0.16♂ 0.16♀	0.04♂ 0.04♀	3.75-4.00♂ 4.00♀

teeth small and acute; movable finger with one small curved apical lobe and one distinct tooth-like sub-apical lobe.

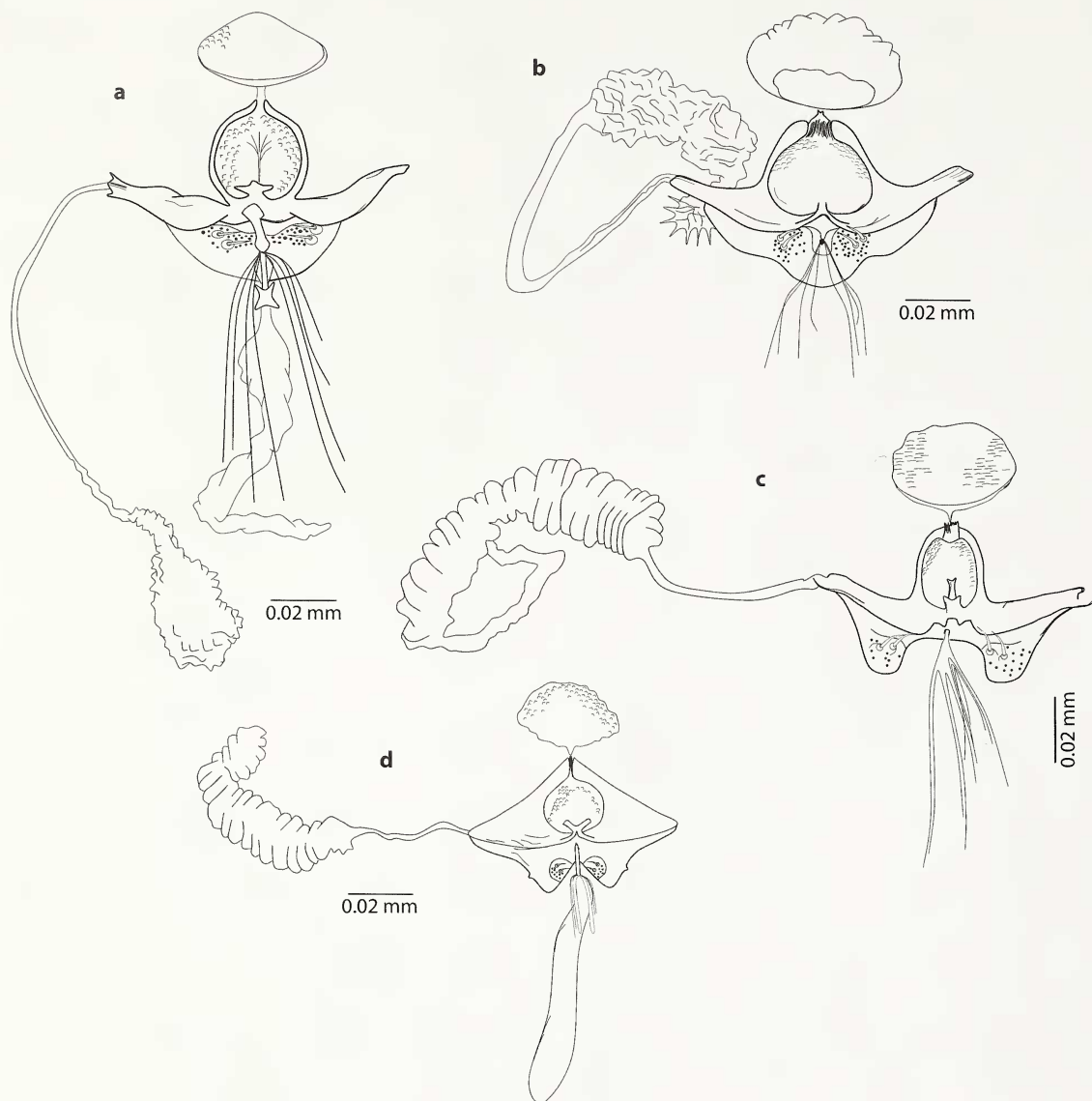
*Pedipalps*: darker in colour than carapace, chela darker in colour than femur and patella, lateral margin of chela darkest; entirely smooth; all setae simple and acute; femur with 2 tactile setae situated dorsally (Fig. 4), first tactile seta situated on basal third and second tactile seta situated approximately in the middle of femur in distance, with distinct pedicel; patella with 6 lyrifissures, 4 lyrifissures situated basally, one lyrifissure located ventromedially and one lyrifissure situated distally; chela with distinct pedicel (Fig. 3); movable finger 1.23-1.50 times longer than hand (with pedicel); fixed finger with 8 and movable finger with 4 trichobothria (Fig. 2); fixed finger with trichobothrium *et* situated close to tip of finger, *it* situated closer to *est* than to *et*, *ist* situated between *est* and *isb* and slightly closer to *isb*, *isb* situated on retrolateral side of the finger, *esb* situated slightly anterior to *ib*, *ib* situated basally; movable finger with trichobothrium *st* situated closer to *sb* than to *t*, *sb* situated very close to *b*; fixed finger with 14-23 sensory setae, 8-10 situated close to trichobothrium *et* and fingertip on the distolateral face; fixed and movable fingers with equal numbers of teeth, both fingers with 24-30 teeth; nodus ramosus present, situated anterior to trichobothrium *et* in fixed finger (Fig. 2) and distinctly closer to tip of finger than trichobothrium *t* in movable finger (Fig. 2); venom ducts inconspicuous, narrow and short in both fingers.

*Legs*: light brown; lighter in colour than carapace and darker than first three tergites; not granulate; all setae simple and acute; claws symmetrical, stout and short; arolia simple and much longer than claws, not divided; each coxa I with 4, coxa II with 4-5, coxa III with 4-5 and coxa IV with 9-10 simple and acute setae (Fig. 6); leg I ratios of males femur L/ patella L 1.26-1.42 and of females femur L/ patella L 1.31; tarsus IV with one tactile seta situated basally (Fig. 7).

**Remarks.** The specimens examined for this study resemble in their pedipalpal dimensions *Olpium intermedium* Beier, 1959 from Afghanistan (Beier 1959), *O. lindbergi* Beier, 1959 from Afghanistan, Pakistan, India and Kazakhstan (summarized in Harvey 2013), and *O. omanense* Mahnert, 1991 from Oman (Mahnert 1991) (see Tab. 2). The female type specimen of *O. omanense* has four setae on the posterior margin of the carapace and three setae on ter-



**Figs 8-14:** *Cardiolpium bisetosum* sp. nov., holotype male: **8.** Body, dorsal view (showing chaetotaxy of carapace and tergites); **9.** Basal segments of pedipalp, dorsal view; **10.** Paratype male, chela, dorsal aspect; **11.** Chela, prolateral view; **12a.** Chelicera, dorsal view (serrula omitted); **12b.** Rallum; **13.** Metatarsus and tarsus I; **14.** Metatarsus and tarsus IV



**Fig. 15:** male genitalia, ventral view: **a.** *Olpium omanense*; **b.** *Minniza babylonica*; **c.** *Calocheiridius iranicus*; **d.** *Cardiolpium bisetosum* sp. nov. [holotype]

gite I (Mahnert 1991); *O. intermedium* has four setae on the posterior margin of the carapace and tergite I; and *O. lindbergi* has only two setae on the posterior margin of carapace and tergite I.

Dashdamirov (2005) tentatively attributed several specimens from Pakistan to *O. lindbergi*, but most had four setae on the posterior margin of the carapace (erroneously stated to be tergite I; and one female had six such setae), and two setae on tergite I. The validity of these species must rely on the exa-

mination of a wide range of specimens across the Middle East, so that intraspecific variation in this genus can be more fully assessed. It is most likely that the specimens from Pakistan were misidentified as *O. lindbergi* by Dashdamirov (2005) and should be referred to *O. omanense*. The presence of fine granules on the prolateral face of the chelal hand in the Pakistani material is the only observable difference between the type specimen of *O. omanense* which was described by Mahnert (1991) and the newly collected

**Tab. 2:** Measures, ratios and chaetotaxy of the basic morphological characters of the species *O. omanense*, *O. lindbergi* and *O. intermedium* [L = Length; W = Width; Fix. = Fixed finger; Mov. = Movable finger; - = without pedicel; + = with pedicel] (based on the specimens examined by Beier (1959), Mahnert (1991) and Dashdamirov (2005))

Species	Femur L	Femur W	Patella L	Patella W	Chela W	Hand (-) L	Movable finger L	Chela (+) L/W	Teeth Fix.	Mov.	Chaetotaxy Cara- pace	Tergite I
<i>Olpium omanense</i> (from Oman)	0.51♀	0.17♀	0.47♀	0.20♀	0.33♀	-	0.54♀	2.90♀	30♀	33♀	4: 6: 4: 4: 4♀	3♀
<i>Olpium omanense</i> (from Iran)	0.48♀ 0.44- 0.48♂	0.14♀ 0.13- 0.14♂	0.43♀ 0.38- 0.42♂	0.17♀ 0.15- 0.16♂	0.27♀ 0.23- 0.25♂	-	0.50♀ 0.46- 0.48♂	3.29- 3.36♀ 3.26- 3.30♂	24-30	24-30	4: 6: 4: 4: 2: 4[3!]	2 [3!]
<i>Olpium omanense</i> (from Pakistan)	0.50♀ 0.44♂	0.152♀ 0.13♂	0.46♀ 0.45♂	0.18♀ 0.16♂	0.29♀ 0.24♂	-	0.53♀ 0.46♂	3.14♀ 3.54♂	-	-	Pos- terior margin: 4 [6!]	2
<i>Olpium lindbergi</i> (from Afghanistan)	0.51♀ 0.47♂	0.16♀ 0.14♂	0.49♀ 0.45♂	0.18♀ 0.16♂	0.27♀ 0.24♂	0.46♀ 0.42♂	0.47♀ 0.47♂	3.30- 3.50	31-32	31-32	Pos- terior margin: 2	2
<i>Olpium intermedium</i> (from Afghanistan)	0.55♀ 0.49♂	0.15♀ 0.14♂	0.52♀ 0.48♂	0.18♀ 0.17♂	0.32♀ 0.27♂	0.50♀ 0.43♂	0.53♀ 0.49♂	3.20♀ 3.40♂	34	30	Pos- terior margin: 4	4

specimens from Iran. Given the similarity in dimensions, number of chelal teeth, and the trichobothrial pattern, the newly collected specimens from Iran and the Pakistani material are attributed to *O. omanense* which is characterized by the presence of four (or six) setae on the posterior margin of carapace and two or three setae on tergite I (see Tab. 2).

**Subfamily Hesperolpiinae Hoff, 1964**

**Genus *Cardiolpium* Mahnert, 1986**

**Type species.** *Apolpiolum stupidum* Beier, 1963, by original designation (Mahnert 1986: 148-149).

**Remarks.** The genus *Cardiolpium* belongs to the subfamily Hesperolpiinae, and resembles *Calocheirus* Chamberlin, 1930, which is the only other genus of Hesperolpiinae which is known from Asia. They differ in the position of trichobothria *isb* and *ist* (Mahnert 1986). All Hesperolpiinae possess long venom ducts, generally situated distinctly proximal to *et* in the fixed chelal finger and to *it* in the movable chelal finger and the patella of leg I is distinctly shorter than femur I (Hoff 1964). This tribe of the family Olpiidae has been considered as a subfamily by Harvey & Leng (2008). *Cardiolpium* comprises two described species, *C. stupidum* (Beier, 1963) from Greece, Israel, Turkey, Turkmenistan and Uzbekistan and *C. aeginense* (Beier, 1966) from Greece (see Harvey 2013).

***Cardiolpium bisetosum* sp. nov.** (Figs 8-14, 15d)  
**Material examined.** IRAN: Markazi Province: holotype ♂, Alvand Protected Area, mountain habitat, soil and litter aggregated between stones, [33°45'45"N, 49°43'30"E, H. undetermined], 8 June 2013, M. Nas-sirkhani (IAUA). Paratype ♂, collected with holotype (IAUA).

**Diagnosis.** *Cardiolpium bisetosum* sp. nov. differs from the other two species of the genus by the following combination of characters: the presence of two or three setae on the posterior margin of carapace and tergite I (four setae in *C. stupidum* and *C. aeginense*); the morphometric characters especially the chelal hand (with pedicel) L/W is 0.20-0.26/0.14-0.17 mm (the chelal hand (without pedicel) L/W is 0.29/0.18 mm in *C. stupidum* and 0.34/0.24 mm in *C. aeginense*); the trichobothriotaxy e.g. the position of trichobothrium *st* on the movable chelal finger which is located nearly midway between *t* and *sb* (situated distinctly closer to *sb* than to *t* in *C. stupidum*).

**Description.** Males (Figs 8-14 & 15d)  
*Carapace:* light reddish brown, lateral margins darker; entirely smooth; clearly longer than wide; with 2 pairs of well-developed corneate eyes, both eyes equal in size (Fig. 8); transverse furrows absent; carapace with setae arranged: 4: 6: 4: 2: 4: 2 (paratype with 3 setae); setae simple, thin and acute; with



**Tab. 3:** Dimensions (in mm) and ratios of morphological characters in *Cardioplium bisetosum* **sp. nov.**

	Length	Width	Ratio
Body	1.27-1.55	-	-
Carapace	0.36-0.44	0.28-0.35	1.25-1.28
Pedipalp			
Trochanter	0.15-0.17	0.09-0.10	1.66-1.70
Femur	0.33-0.40	0.09-0.10	3.66-4.00
Patella	0.23-0.27	0.08-0.11	2.87-3.36
Chela (with pedicel)	0.52-0.65	0.14-0.17	3.64-3.86
Chela (without pedicel)	0.47-0.60	-	3.35-3.64
Hand (with pedicel)	0.20-0.26	-	1.42-1.52
Movable finger	0.33-0.39	-	-
Legs	Length	Depth	Ratio
Leg I			
Femur	0.16-0.20	0.05-0.06	3.16-3.33
Patella	0.09-0.10	0.05-0.06	1.66-1.83
Femur L./patella L.	-	-	1.77-2.00
Tibia	0.11-0.14	0.04	2.75-3.50
Metatarsus	0.11-0.12	0.03	3.66-4.00
Tarsus	0.08-0.11	0.02	4.00-5.50
Leg IV			
Femur	0.10-0.11	0.09	1.11-1.22
Patella	0.24-0.26	0.12-0.14	2.00-2.16
Femur + patella	0.27-0.36	-	2.25-2.69
Tibia	0.21-0.26	0.05-0.06	4.20-4.22
Metatarsus	0.14-0.16	0.03-0.04	4.00-4.66
Tarsus	0.11-0.14	0.02-0.03	4.66-5.50

8 lyrifissures, first pair situated laterally on anterior margin, second pair situated close to terminal margin of posterior eyes, third pair situated medially and last pair situated on posterior margin.

*Tergites:* lightly sclerotized and entirely smooth; without median suture line; slightly darker in colour than carapace except tergites I–IV slightly lighter in colour than carapace and tergite XII completely pale and membranous, most tergites commonly brown with yellowish margins; with long acute and simple setae; tergite X with two slightly long setae situated laterally and two long tactile setae situated medially; tergite XI with 2 long tactile setae situated latromedially (Fig. 8); tergites with setae arranged: 2: 4: 4–5: 6: 6: 6: 6: 6: 6: 6: 6: 2.

*Sternites:* yellowish brown; poorly sclerotized; entirely smooth; without median suture line; sternite II with 11 simple setae; with genital sacs and slightly long lateral ducts, with 2 pairs of internal glandular setae (Fig. 15d); setae narrower and longer than tergal setae; sternite X with 2 slightly setae; sternite XI with 4 long tactile setae; anterior tracheal trunk enlarged normally and posterior tracheal trunk enlarged in the basal zone, posterior tracheal trunk clearly thinner than anterior one; sternites with setae arranged: 11-12: (0)5-8(0): (0)5-6(0): 4-6: 4-6: 5-6: 5-6: 6: 6-7: 6-8: 2.

*Pleural membrane:* longitudinally striate.

*Chelicera:* brown; galeal seta situated sub-distally; galea with 2 terminal and one lateral rami; hand with 5 setae (Fig. 23a); rallum with 3 blades (Fig. 12b), distal blade longer and wider with short lateral denticulations; serrula exterior with 14 blades; fixed finger with 6 teeth, two first teeth acute and small; movable finger with a small apical lobe and one sub-apical tooth.

Pedipalps: uniformly reddish brown, darker in colour than carapace and chelicera; entirely smooth; setae simple and acute; femur with indistinct pedicel, with 1 tactile seta located in basal third (Fig. 9); patella with 5 lyrifissures, 4 lyrifissures situated basally and one lyrifissure located distally; chela with short pedicel (Figs 10, 11); prolateral margin of chela distinctly curved distally (Fig. 10); movable finger distinctly longer than hand (with pedicel); movable finger 1.50-1.65 longer than hand (with pedicel); fixed finger with 8 and movable finger with 4 trichobothria (Fig. 11); fixed finger with trichobothrium it situated slightly closer to trichobothrium et than ist, et situated closer to tip of finger than it; est situated closer to ib than ist; isb situated slightly posterior to ib on retrolateral side and isb, ib, esb and eb aggregated basally; movable finger with trichobothrium t situated in distal third, st slightly closer to sb than t, sb situated very close to b; sensory setae in the tip of fixed finger absent; each finger with a row of sensory setae; fixed finger with large, acute and triangular teeth; movable finger with small and blunt teeth; fixed finger with 32-34 teeth and movable finger with 10-12 teeth; nodus ramosus present, situated slightly posterior to t in movable finger and near to it in fixed finger (Fig. 11).

*Legs:* yellowish brown; lighter in colour than carapace; smooth; all setae simple and acute; claws symmetrical, stout and short; arolia simple and lon-



**Tab. 4:** The measures, ratios and chaetotaxy of the basic morphological characters of the species of *Cardiolum* [for abbreviations see Tab. 2] (incl. data from Beier 1963, 1966).

Species	Femur		Patella		Chela	Hand	Hand	Movable	Chela	Chaetotaxy	
	L.	W.	L.	W.	W.	(-) L.	(+) L.	finger L.	(+) L/W	Carapace	Tergite I
<i>Cardiolum stupidum</i> (Beier)	0.43♂	0.11♂	0.28♂	0.10♂	0.18♂	0.29♂	-	0.37♂	3.40♂	Posterior margin: 4	4
<i>Cardiolum aeginense</i> (Beier)	0.46♀	0.115♀	0.34♀	0.115♀	0.24♀	0.34♀	-	0.43♀	3.10♀	Posterior margin: 4	4
<i>Cardiolum bisetosum</i> sp. nov.	0.33-0.40♂	0.09-0.10♂	0.23-0.27♂	0.08-0.11♂	0.14-0.17♂	-	0.20-0.26♂	0.33-0.39♂	3.64-3.86♂	Posterior margin: 2 [3!]	2

ger than claws (Figs 13, 14); coxae with setae arranged: 4-5:4-5:5:5-6; most setae simple and acute; joint between femur and patella III and IV indistinct; metatarsus IV with one tactile seta situated basally; tarsus IV with one tactile seta located distad of middle.

**Remarks.** *Cardiolum bisetosum* sp. nov. can be distinguished from the two other species of the genus, *Cardiolum stupidum* (Beier, 1963) and *C. aeginense* (Beier, 1966), by the position of trichobothrium *st* in the movable chelal finger. In *C. bisetosum* sp. nov., trichobothrium *st* is located approximately in the middle of distance between trichobothria *sb* and *t*, clearly distal to *est* in the fixed chelal finger while it is located distinctly closer to *sb* than to *t*, approximately at the same level as *est* in *C. stupidum*, and situated closer to *sb* than to *b*, slightly distal to *est* in *C. aeginense*. Also, the chelal hand (with pedicel) of the new species is shorter than the chelal hand (without pedicel) of *Cardiolum stupidum* and *Cardiolum aeginense* (see Tab. 4). According to Beier (1963, 1966), the other species of *Cardiolum* have four setae on the posterior margin of the carapace and tergite I, so the presence of two or three setae on the posterior margin of the carapace and tergite I may be considered as another difference between the species, but larger numbers of specimens from a variety of locations are required to assess the level of intraspecific variation.

**Etymology.** This species is named for the presence of two setae on the posterior margin of the carapace and tergite I (*bisetosum*, bi + setose/setous, Latin, having two bristles).

#### Acknowledgements

The author wishes to extremely thank Dr. Mark S. Harvey for encouragement, and Mr. Mahmoud Nassirkhani for his assistance.

#### References

- Beier M 1951 Ergebnisse der österreichischen Iran-Expedition 1949/50, Pseudoscorpione und Mantiden. – Annalen des Naturhistorischen Museums in Wien 58: 96-101
- Beier M 1959 Zur Kenntnis der Pseudoscorpioniden-Fauna Afghanistans. – Zoologische Jahrbücher, Abteilung für Systematik, Ökologie und Geographie der Tiere 87: 257-282
- Beier M 1963 Die Pseudoscorpioniden-Fauna Israels und einiger angrenzender Gebiete. – Israel Journal of Zoology 12: 183-212
- Beier M 1966 Zoologische Aufsammlungen auf Kreta. Pseudoscorpionidea. – Annalen des Naturhistorischen Museums in Wien 69: 343-346
- Beier M 1971 Pseudoscorpione aus dem Iran. – Annalen des Naturhistorischen Museums in Wien 75: 357-366
- Chamberlin JC 1931 The arachnid order Chelonethida. – Stanford University Publications. Biological Sciences 7(1): 1-284
- Dashdamirov S 2005 Pseudoscorpions from the mountains of northern Pakistan (Arachnida: Pseudoscorpiones). – Arthropoda Selecta 13(4)(2004): 225-261
- Dashdamirov S & Schawaller W 1993. Pseudoscorpions from Middle Asia, Part 2 (Arachnida: Pseudoscorpiones). – Stuttgarter Beiträge zur Naturkunde A496: 1-14
- Harvey MS 1992 The phylogeny and classification of the Pseudoscorpionida (Chelicerata: Arachnida). – Invertebrate Taxonomy 6: 1373-1435 – doi: 10.1071/IT9921373
- Harvey MS 2013 Pseudoscorpions of the world, version 3.0 Western Australian Museum. – Internet: <http://museum.wa.gov.au/catalogues-beta/pseudoscorpions> (December 15, 2013)
- Harvey MS & MC Leng 2008 The first troglomorphic pseudoscorpion of the family Olpiidae (Pseudoscorpiones), with remarks on the composition of the family. – Records of the Western Australian Museum 24: 387-394
- Harvey MS, Ratnaweera PB, Randeniya PV & Wijesinghe MR 2012 A new species of the pseudoscorpion genus *Megachernes* (Pseudoscorpiones: Chernetidae) associated with a threatened Sri Lankan rainforest rodent, with a review of host associations of *Megachernes*. – Journal of Natural History 46: 2519-2535 – doi: 10.1080/00222933.2012.707251

- Hoff CC 1964 The pseudoscorpions of Jamaica, part 3, the suborder Diplosphyronida. – Bulletin of the Institute of Jamaica, Science Series 10(3): 1-47
- International Commission on Zoological Nomenclature 1987 Opinion 1423. *Olpium* Koch, 1873 (Arachnida): *Obisium pallipes* Lucas, [1846] designated as type species; interpretation of the nominal species *Olpium kochi* Simon, 1881. – Bulletin of Zoological Nomenclature 44: 53-54
- Judson MLI 2007 A new and endangered species of the pseudoscorpion genus *Lagynochthonius* from a cave in Vietnam, with notes on chelal morphology and the composition of the Tyrannochthoniini (Arachnida, Chelonethi, Chthoniidae). – Zootaxa 1627: 1-56
- Koch L 1873 Uebersichtliche Darstellung der europäischen Chernetiden (Pseudoscorpione) – Bauer & Raspe: Nürnberg. 68 pp.
- Mahnert V 1986 Une nouvelle espèce du genre *Tyrannochthonius* Chamb. des îles Canaries, avec remarques sur les genres *Apolpiolum* Beier et *Calocheirus* Chamberlin (Arachnida, Pseudoscorpiones). – Mémoires de la Société Royale Entomologique de Belgique 33: 143-153
- Mahnert V 1991 Pseudoscorpions (Arachnida) from the Arabian Peninsula. – Fauna of Saudi Arabia 12: 171-199
- Nassirkhani M 2014 A new pseudoscorpion species of the genus *Calocheiridius* Beier & Turk (Arachnida: Pseudoscorpiones: Olpiidae) from Iran. – Zoology in the Middle East 60: 353-361 – doi: 10.1080/09397140.2014.966520
- Nassirkhani M & Vafai Shoushtari R 2014 Redescription and remarks on the species *Minniza persica* (Pseudoscorpiones: Olpiidae) from Iran. – Zoology in the Middle East 60: 272-277 – DOI: 10.1080/09397140.2014.939814